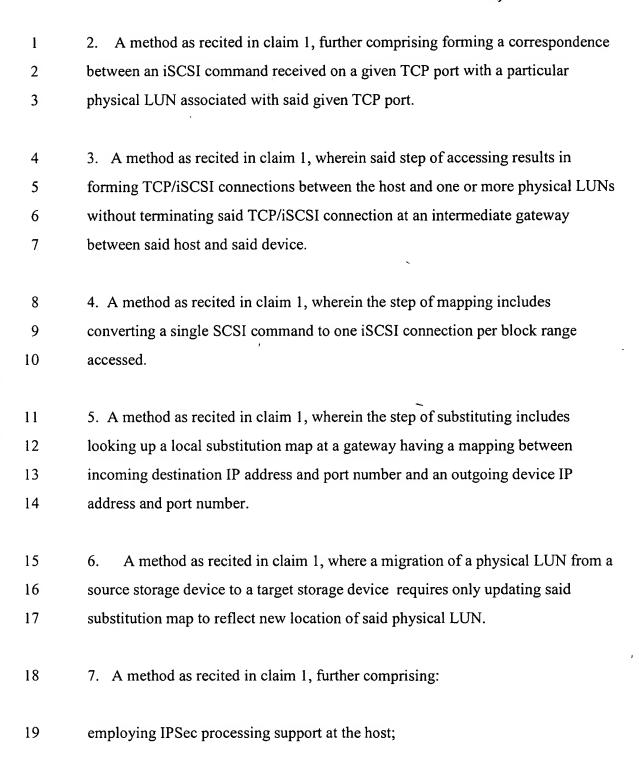1 **CLAIMS**

2 Having thus described our invention, what we claim as new and desire to secure

3 by Letters Patent is as follows:

4 1. A method comprising accessing virtual iSCSI storage, including the steps of:

5 defining at least one physical logical unit number (LUN) on a physical storage

6 device having an device IP address;

7 associating a unique TCP port number with each said at least one physical LUN;

8 replacing a first LUN identifier specified in said iSCSI command with a second

9 LUN identifier associated with said given TCP port number;

10 establishing a unique IP address at which a virtual LUN is accessed from a host;

11 identifying a block TCP port number with each block range of said virtual LUN;

12 mapping a SCSI command to one or more iSCSI/TCP connections having said

13 unique IP address and the block TCP port number identified with said each block

14 range referenced by said SCSI command; and

15 substituting said unique IP address and said block TCP port number with said

16 device IP address and said given TCP port number on packets between said host

17 and said storage devices.

1   2. A method as recited in claim 1, further comprising forming a correspondence

2   between an iSCSI command received on a given TCP port with a particular

3   physical LUN associated with said given TCP port.

4   3. A method as recited in claim 1, wherein said step of accessing results in

5   forming TCP/iSCSI connections between the host and one or more physical LUNs

6   without terminating said TCP/iSCSI connection at an intermediate gateway

7   between said host and said device.

8   4. A method as recited in claim 1, wherein the step of mapping includes

9   converting a single SCSI command to one iSCSI connection per block range

10   accessed.

11   5. A method as recited in claim 1, wherein the step of substituting includes

12   looking up a local substitution map at a gateway having a mapping between

13   incoming destination IP address and port number and an outgoing device IP

14   address and port number.

15   6.   A method as recited in claim 1, where a migration of a physical LUN from a

16   source storage device to a target storage device requires only updating said

17   substitution map to reflect new location of said physical LUN.

18   7. A method as recited in claim 1, further comprising:

19   employing IPSec processing support at the host;

20   employing IPSec processing support at a gateway between said host and said

21   storage device; and

1   forming an IPSec tunnel between said host and said gateway;

2   10. A method comprising providing support at a physical storage device for

3   accessing virtual iSCSI storage, including the steps of:

4   defining at least one physical logical unit (LUN) on the physical storage device

5   having an device IP address;

6   associating a unique TCP port number with each said at least one physical LUN;

7   and

8   replacing a first LUN identifier specified in said iSCSI command with a second

9   LUN identifier associated with said given TCP port number.

10   11. A method comprising providing support at a host for accessing virtual iSCSI

11   storage, including the steps of:

12   establishing a unique IP address at which a virtual LUN is accessed from the host;

13   identifying a block TCP port number with each block range of said virtual LUN;

14   and

15   mapping a SCSI command to one or more iSCSI/TCP connections having said

16   unique IP address and the block TCP port number identified with said each block
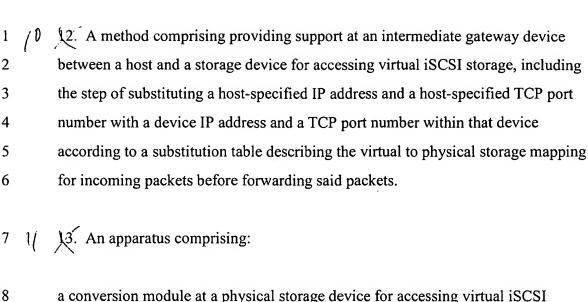
17   range referenced by said SCSI command;

1   10   12. A method comprising providing support at an intermediate gateway device

2   between a host and a storage device for accessing virtual iSCSI storage, including

3   the step of substituting a host-specified IP address and a host-specified TCP port

4   number with a device IP address and a TCP port number within that device

5   according to a substitution table describing the virtual to physical storage mapping

6   for incoming packets before forwarding said packets.

7   11   13. An apparatus comprising:

8   a conversion module at a physical storage device for accessing virtual iSCSI

9   storage, coupled to means for defining at least one physical logical unit (LUN) on

10   the physical storage device having an device IP address; and coupled to means for

11   associating a unique TCP port number with each said at least one physical LUN;

12   said conversion module to replace a first LUN identifier specified in said iSCSI

13   command with a second LUN identifier associated with said given TCP port

14   number.

15   12   14. An apparatus at a physical storage device for accessing virtual iSCSI storage,

16   comprising:

17   means for replacing a first LUN identifier specified in an iSCSI command with a

18   second LUN identifier associated with a given TCP port number included in said

19   iSCSI command;

20   means for defining at least one physical logical unit (LUN) on the physical

21   storage device having an device IP address; and

1   means for associating a unique TCP port number with each said at least one

2   physical LUN.

3   13. 15. An apparatus comprising a virtualization module at a host for accessing

4   virtual iSCSI storage, said virtualization module includes:

5   means for establishing a unique IP address at which a virtual LUN is accessed

6   from the host;

7   means for identifying a block TCP port number with each block range of said

8   virtual LUN; and

9   means for mapping a SCSI command to one or more iSCSI/TCP connections

10   having said unique IP address and the block TCP port number identified with said

11   each block range referenced by said SCSI command.

12   14. 16. An apparatus comprising a virtualization module at a host for accessing virtual

13   iSCSI storage, said virtualization module includes:

14   a control module establishing a unique IP address at which a virtual LUN is

15   accessed from the host, and for identifying a block TCP port number with each

16   block range of said virtual LUN; and

17   a driver module for mapping a SCSI command to one or more iSCSI/TCP

18   connections having said unique IP address and the block TCP port number

19   identified with said each block range referenced by said SCSI command.

20   15. 17. An apparatus comprising:

1   an address translation module at an intermediate gateway device between a host

2   and a storage device for accessing virtual iSCSI storage, said address translation

3   module having a substitution table describing a virtual to physical storage

4   mapping, said address translation module to replace a host-specified IP address

5   and a host-specified TCP port number with a device IP address and a TCP port

6   number within said intermediate gateway device according to the substitution

7   table for incoming packets before forwarding said incoming packets.

8   /16 18. An apparatus at an intermediate gateway device between a host and a storage

9   device for accessing virtual iSCSI storage,

10   said intermediate gateway device having a a substitution table, said substitution

11   table describing a virtual to physical storage mapping of IP addresses and TCP

12   port numbers; said apparatus comprising:

13   means for replacing a host-specified IP address and a host-specified TCP port

14   number, with an IP address and a TCP port number of the storage device, within

15   said intermediate gateway device, according to the substitution table for incoming

16   packets before forwarding said incoming packets.

.17   /17 19. An article of manufacture comprising a computer usable medium having

18   computer readable program code means embodied therein for causing accessing

19   virtual iSCSI storage,, the computer readable program code means in said article

20   of manufacture comprising computer readable program code means for causing a

21   computer to effect the steps of claim 1.

22   /18 20. A program storage device readable by machine, tangibly embodying a

23   program of instructions executable by the machine to perform method steps for

1   accessing virtual iSCSI storage,, said method steps comprising the steps of claim

2   1..

3   /9 21. A computer program product comprising a computer usable medium having

4   computer readable program code means embodied therein for causing LUN

5   identifier substitution, the computer readable program code means in said

6   computer program product comprising computer readable program code means

7   for causing a computer to effect the functions of claim 13.

8   20 22. A computer program product comprising a computer usable medium having

9   computer readable program code means embodied therein for causing LUN

10   identifier substitution, the computer readable program code means in said

11   computer program product comprising computer readable program code means

12   for causing a computer to effect the functions of claim 14.

13 21 23. A computer program product comprising a computer usable medium having

14   computer readable program code means embodied therein for causing SCSI

15   command mapping, the computer readable program code means in said computer

16   program product comprising computer readable program code means for causing

17   a computer to effect the functions of claim 15.

18 22 24. A computer program product comprising a computer usable medium having

19   computer readable program code means embodied therein for causing SCSI

20   command mapping, the computer readable program code means in said computer

21   program product comprising computer readable program code means for causing

22   a computer to effect the functions of claim 16.

1 23 25. A computer program product comprising a computer usable medium having

2 computer readable program code means embodied therein for causing address

3 substitution, the computer readable program code means in said computer

4 program product comprising computer readable program code means for causing

5 a computer to effect the functions of claim 17.

6 24 26. A computer program product comprising a computer usable medium having

7 computer readable program code means embodied therein for causing address

8 substitution, the computer readable program code means in said computer

9 program product comprising computer readable program code means for causing

10 a computer to effect the functions of claim 18.